Webinar for National Renewable Energy Laboratory
by Hitachi Energy and Environmental Efficiency

Energy Conservation, Sensors, and Security:
Reduce energy costs, increase resource efficiency, and protect data

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Discussion Topics

HITACHI
Inspire the Next

Section 1	Hitachi Social Innovation and Industry Info	Rose Gabriele

Section 2	Hitachi Consulting Introduction and Solutions
	Hitachi Global
	Hitachi Energy and Environmental Efficiency – HE3
	    Energy Savings as a Service
	    Environmental, Health and Safety
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Section 3	Solutions with Sensors	Todd Hunter
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Hitachi Social Innovation and Industry Info

Hitachi Social Innovation

SOCIAL INNOVATION
IT'S OUR FUTURE

Hitachi SOCIAL INNOVATION FORUM
Riyadh

THE FUTURE IS OPEN TO SUGGESTIONS - Hitachi

Industry Statistics

Growth of Profitable Energy Efficiency Initiatives

- In 2015, corporate buyers added 3.23 GW of new renewable power capacity[1]

- 43% of Fortune 500 companies have set renewable energy targets[2]

- Approximately $1.1 billion in annual savings for 53 Fortune 100 companies[3]

- Most organizations can save 2-10% annually through optimized energy management[4]

- There is a 99% chance that 2016 will be the warmest year on record[5]

- The world is heating up at a rate at least 20 times faster than the historical average[6]

Source: 1. GreenBiz.com 2. GreenBiz.com 3. Ceres.org 4. EnergyStar.gov 5. NASA 6. NASA

Pressure to Reduce Energy Consumption

Global energy consumption expected to rise 48% by 2040*

- Aging infrastructures

- Expansive buildings and factories

- Large energy footprints

- Increasing energy requirements

- Regulations and market demands driving energy costs higher

*Source: International Energy Outlook 2016

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Hitachi Consulting
Introduction and Solutions

Hitachi, Ltd. – A Global Technology Leader

Hitachi, Ltd. ranks 79th on the 2016 Fortune Global 500®

$88.8B
FY15 revenue

More than 100 years of product and service innovation, engineering and quality.

77
countries
320,000+
employees

$2.9B
Invested in R&D (2015)

Focused

Strategic focus on Social Innovation, answering society's challenges.

Clear

Society Changes, **Hitachi Transforms It.**

One-Hitachi Support Global Clients

Serving more than 350 clients globally in 170 nations

Technology, Energy Ops, Implementation, Support, Infrastructure, and Cloud Solutions

24/7, Follow the Sun model, seamlessly connected to our clients worldwide
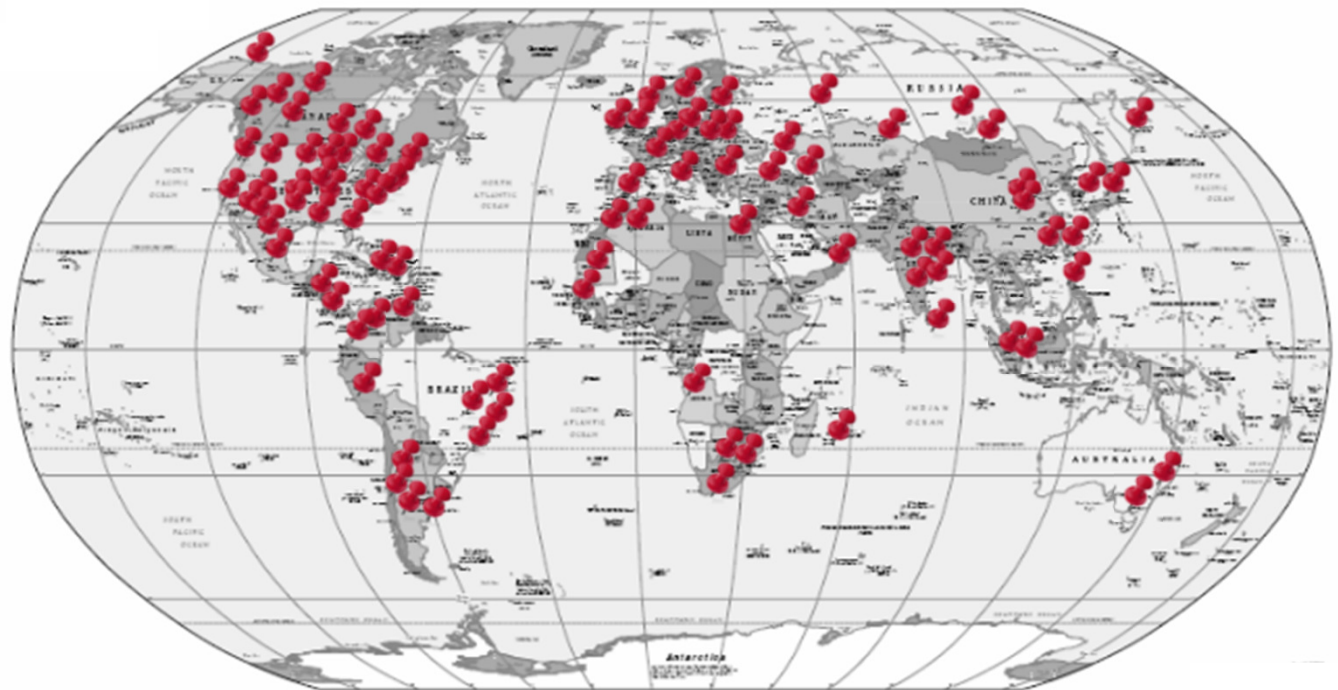
Deep Industry Insight

Management consulting, technology solutions, and outsourcing services

Aerospace and Defense	Chemicals	Communication	Consumer and Retail
Energy and Utilities	Financial Services and Private Equity	Government and Security	Health Care
Industrials	Life Sciences	Metals and Mining	Transportation

Better

Global Expertise.
Locally Deployed.
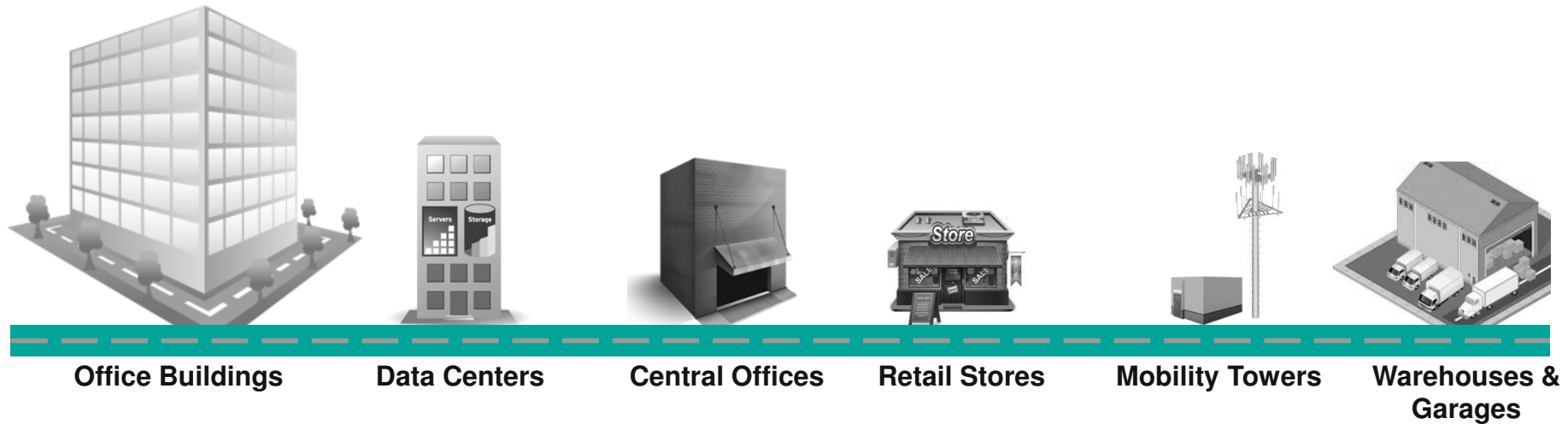
Achieve Resource-Saving Goals

Hitachi has decades of experience with environmental and energy-saving solutions

- Support objectives as a combined One-Hitachi

- Set strategies from assessments to post-installation support and reporting

- Deliver IoT solutions that increase efficiency and lower costs

- Provide innovative financing options

Facility Types

Hitachi Consulting Energy and Environmental Solutions can help all types of facilities increase efficiency and reduce costs.

Office Buildings   **Data Centers**   **Central Offices**   **Retail Stores**   **Mobility Towers**   **Warehouses & Garages**

Hitachi Energy and Environmental Efficiency
Energy Savings as a Service

Energy Savings as a Service (ESaaS)

Reduce energy use and expenses with no upfront capital

- No purchase of new equipment

- Hitachi invests in design, installation, management, and maintenance

- Payments depend on each month's energy savings

- Frees capital for other investments

Innovative Financing Options

Meet energy, sustainability, and EHS goals with flexible financing options
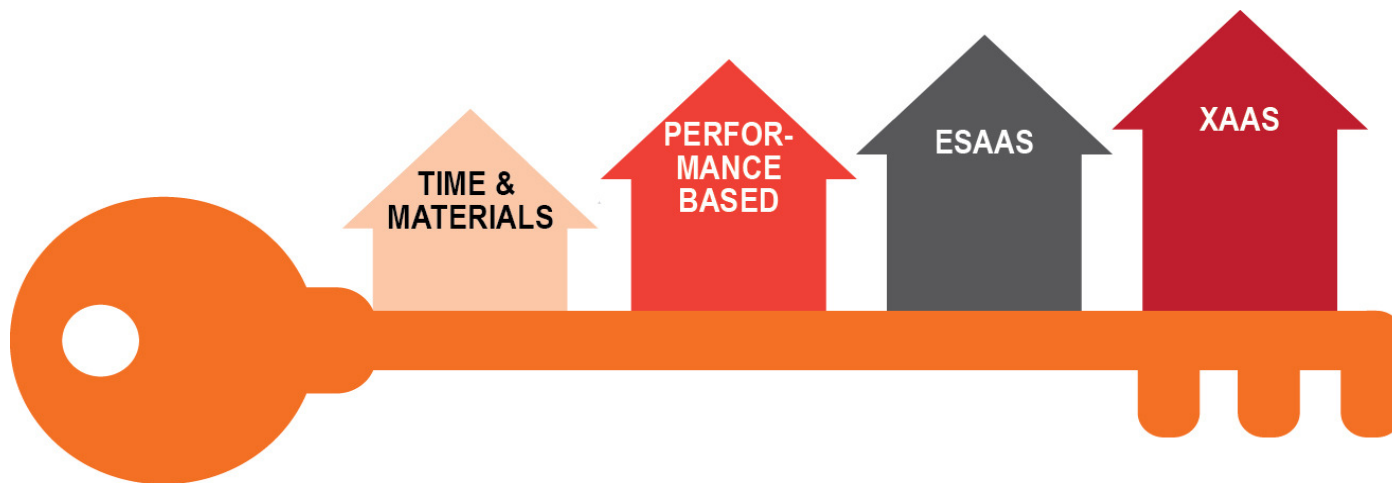
Hitachi Energy and Environmental Efficiency
Environmental, Health and Safety

Environmental Sustainability Solutions

Reach your performance objectives and turn risks into opportunities

- Sustainability Performance Management
- Environmental Health and Safety

Includes:

- Development
- Implementation
- Performance Tracking
- Reporting

Sustainability Performance Management

Build your sustainable vision

- Define/refine sustainability objectives

- Assess environmental footprint

- Determine risks associated with critical resources

- Educate/engage stakeholders

- Monitor performance, report on progress, and make a difference

Environmental Health and Safety

Understand your environmental and safety risks

- Perform compliance audits and assessments

- Refine programs to achieve compliance
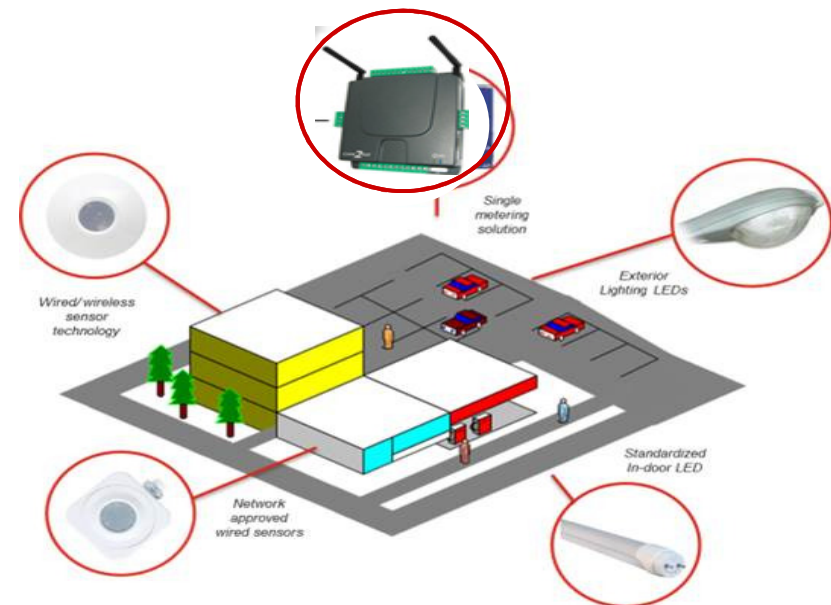
- Build the internal structure and systems

Solutions with Sensors

Lighting

LED lighting retrofits, occupancy sensors, and dimming systems

- Smart Lighting contributes to reduced energy usage, maintenance, disposal, and bulb replacement

- Sensors monitor and manage lights, and relay data to meters

Single metering solution

Wired/wireless sensor technology

Exterior Lighting LEDs

Network approved wired sensors

Standardized In-door LED

Estimated Savings Range:
5% - 30%

HVAC Optimization

Software based technology which uses real-time inputs to identify and maintain optimum chiller plant and Roof Top Unit set points, timing, and operating conditions

- An HVAC system in a commercial building typically accounts for approximately 15-50% of the building's total energy use

- HVAC optimization measurement at different equipment points

- Increases the energy efficiency based on real-time inputs

- Reducing maintenance

- Increases chiller plant capacity

Optimization Technologies

- Variable Frequency Devices

- Temperature Control Devices

- Plant Design Optimization

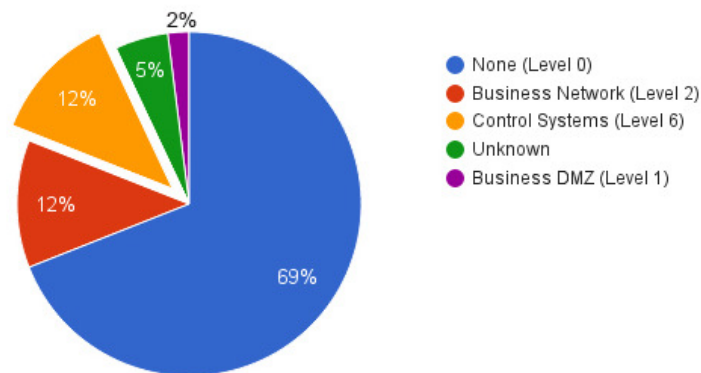- Various Sensors

Estimated Savings Range:

10% - 30%

Sensors and Security Considerations

Energy Efficiency and the Security Challenge

Connecting sensors to a remote monitoring system or to the Cloud, in order to extract data from equipment, continues to pose challenges and security risks with respect to the growth of IoT.

ICS-CERT: Intrusion depth (FY2015)

- None (Level 0) — 69%
- Business Network (Level 2) — 12%
- Control Systems (Level 6) — 12%
- Unknown — 5%
- Business DMZ (Level 1) — 2%

Data source: ICS-CERT (US)

"The IoT has enormous potential to collect continuous data about our environment. The integrity of this data will be important in making personal and business decisions, from medical diagnoses to environmental protection, from commands to modify actions of machinery to identification and authorization of physical access. A black market for fake or corrupted sensor and video data will mean that data can be compromised or substituted with inaccurate or deliberately manipulated data."

Sources: Gartner, ICS –CERT/US; ZDNethttp://www.zdnet.com/article/how-hackers-attacked-ukraines-power-grid-implications-for-industrial-iot-security

Examples of IOT-Related Security Breaches and Risks

As devices, buildings, and *things* become interconnected through the growth of sensors and the IoT, the risk of security breaches also increases.

Energy Sector:

"Cyber attackers successfully compromised the security of U.S. Department of Energy computer systems more than 150 times between 2010 and 2014, according to a review of federal records." [1]

Manufacturing:

"Germany's Federal Office for Information Security (BSI) recently issued a report that confirmed that hackers had breached a steel plant in their country and compromised numerous systems, including components on the production network. As a result, mill personnel were unable to shut down a blast furnace when required, resulting in "massive damage to the system." [2]

Other areas of IoT related risks:

- Consumer related IoT devices
- HealthCare
- Buildings
- Transportation (Cars, Planes)

Sources:
1) http://www.usatoday.com/story/news/2015/09/09/cyber-attacks-doe-energy/71929786/
2) https://www.linkedin.com/pulse/10-most-terrifying-iot-security-breaches-so-far-you-arent-montgomery
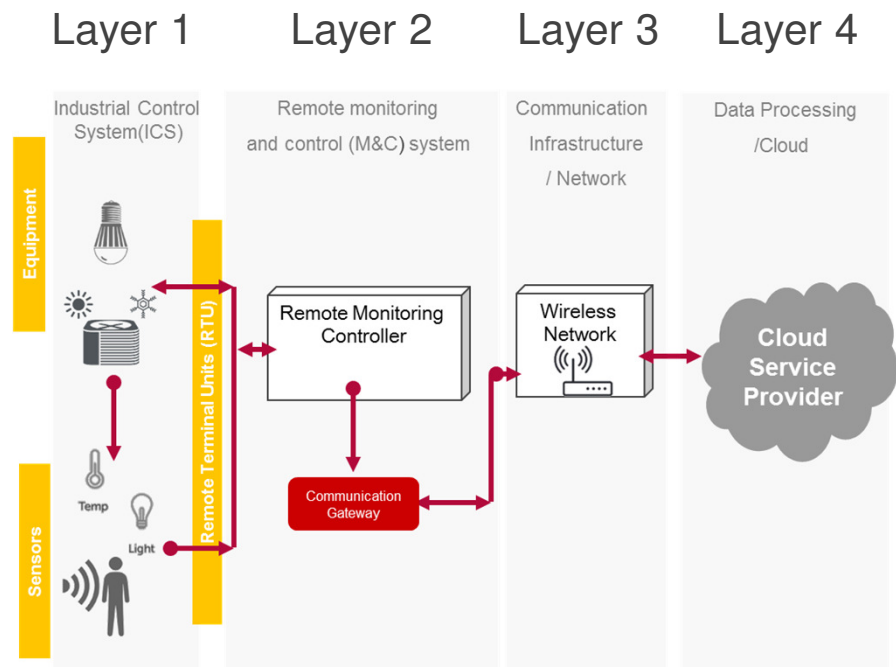
Sensor Network

Common components of sensors or industrial control systems transport data from point to point. These transport points present security challenges and opportunities for organizations to protect their assets.

Example of a Sensor Connected to the Cloud:
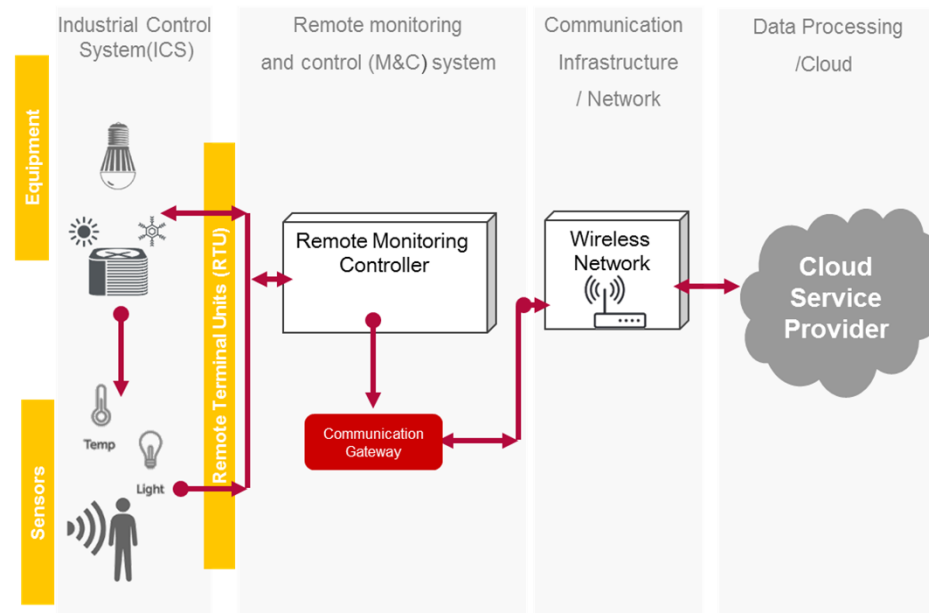
Best Practices for Sensor Security

1. **Control System and Sensor** - Physical security should secure the sensor; logical security methods include security audits, and access control

2. **Remote Monitoring and Control System**- Security Activity Monitoring; who is accessing the remote monitoring layer; if the frequency is predictable

3. **Communications Infrastructure** - Logical Firewalls/VPN, Technology/Encryption

4. **Data Processing / Cloud** – Firewalls and encryption; attack mitigation tools; know your SLA's, the Security architecture of your provider, and the security audits; ensure compliance to security protocols

Layer 1 — Industrial Control System(ICS)
Layer 2 — Remote monitoring and control (M&C) system
Layer 3 — Communication Infrastructure / Network
Layer 4 — Data Processing /Cloud

Wrap Up

Benefits of This Approach

Companies can benefit in many ways from energy savings technology
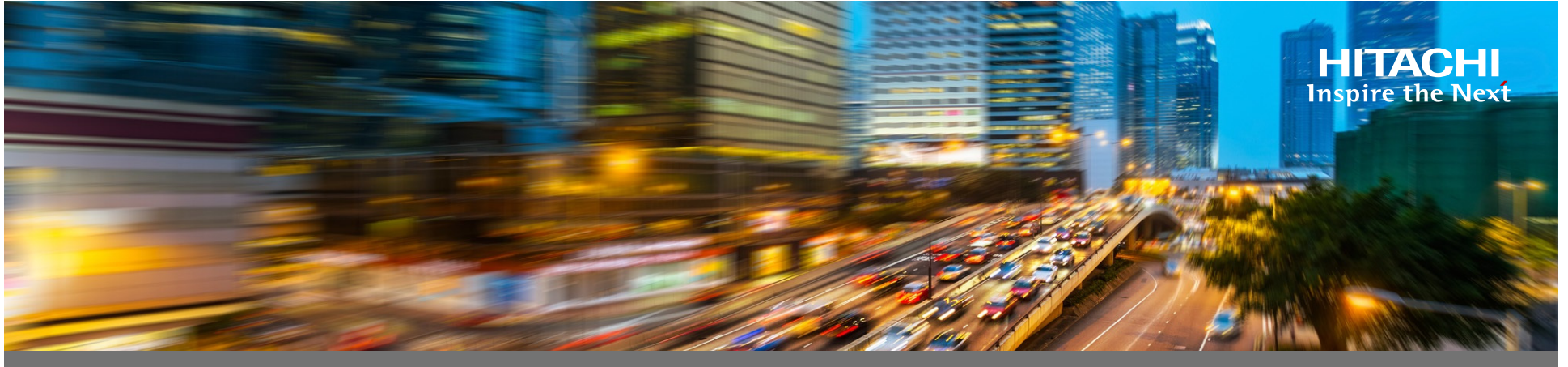
- Work towards meeting environmental and safety regulations

- Reduce energy use and associated costs

- Lower carbon emissions

- Support organizational sustainability goals

What's Next?

Hitachi has developed a repeatable project delivery process to enable consistency of delivery, speed and scale. Delivery timelines vary significantly based on the Service / technology provided. The processes, delivery systems, and organizational structure are customized to ensure customer delivery satisfaction.

1. Select sites for Pilot

   • Select sites where there is good opportunity for savings

2. Audit selected sites

   • Determine energy savings measures fit to facility profile

3. Begin deployment and savings measurement

Questions and Discussion